Power Management Controls

Project Scope and Research Topics

This discussion identifies particular issues that the project needs to (or could) address. Some topics are more important than others. We can't study everything, at least not in detail, so need to have some sense of what is most important.. The PAC will give us feedback on these research topics (and others brought forward at the meeting) so that we can work on those most critical to project success. Including the topic in our research plan does not mean that it will necessarily lead to recommendations about it.

Project Scope

User Interface (UI) Elements

Terms, **Symbols**, **Indicators**, and "**Operating Metaphors**". Operating metaphors are more complex ideas, such as weekly timers, and whether multiple delay timers occur in series or in parallel.

Locations of UI Elements

User Interface Elements may appear fixed on the **outside** of devices, on **displays** (status indicators or control panels), on **remote devices**, or in manuals and other **documentation**. They may help indicate the device's state, the effect of a switch, or the effect of an automatic control.

Types of Devices

Our primary focus is **office equipment** (PCs, monitors, printers, copiers, fax machines, etc.), but attention will be made to other types of electronic devices that consumers commonly interact with (e.g. Portable Digital Assistants, and **consumer electronics**). We expect that in future, power management will be used on many types of devices that presently don't visibly power manage, or device categories that don't exist in any quantity today.

The Project Scope does <u>not</u> include

Issues related safety. Power levels or delay times. Labeling or certification. Security. Internal protocols/mechanisms for power management, including terminology not intended for final users. Discussion or recommendation of ideas subject to intellectual property claims.

Topic Areas

What should we assume about Users?

Language

Standard UI terms will need to be translated to other languages, or become so widely recognized as to not need translation (as an increasing portion of users do not use English at all). Doing this translation is beyond the scope of this project, but we may suggest an appropriate process or organization to accomplish this.

Culture

Any new symbols, words, or colors should be checked for problematic cultural associations that would argue against their use. This is an area in which the international standards community could be particularly helpful.

Disability

The needs of people with disabilities should be considered. Of key concern are those users who are blind, have limited vision, are color-blind, or deaf. This might be accomplished with redundant or standard optional indications. Such standard optional indications might be desirable for other purposes as well (e.g. audio indications when the device can't be seen directly). Many disabilities, such as manual dexterity, do not pose a challenge to this effort, as we don't expect to explore variables that affect mechanical aspects of devices.

How much should we concentrate on particular Device Types

Controlled and controlling devices

Whereas some devices manage their own power status, others (such as monitors) are dependent on a second device to determine when to change the power state. The number of such devices (controlled by others) is likely to rise.

Remote indicators and controls

As devices are increasingly networked, there is more ability of one device (usually a computer) to access the controls of another . This is distinct from(but not exclusive of) the control of one device by another[1]. For example, printers are increasingly managed this way. The content of such user interfaces may be dependent on both the controlled and controlling device. Even a monitor is an example of this as the computer controls the content of the control panel. Printer screen icons on some current computers indicate if the printer is actively imaging. Similarly, screen icons could indicate power status.

TV-like remote controls

With more electronic devices in houses, the ability to control them from small remote controls similar to those used with TVs will become more useful. These may have both button-like controls and indicators; controls for changing automatic power management are perhaps less likely.

Batteries

Battery status presents many potential controls and indicators. Indicators might include battery presence or absence, total capacity (time), remaining capacity (time), battery health, and charging status. Controls might include charging method, and low-battery actions. How deeply to get into battery issues is something for which industry feedback is needed.

Composite devices

A composite device is one in which different components may be in different power states. Many PCs are examples of this, with monitors, extra processors, disks, and communication cards all potentially in different power states from that of the processor. Imaging devices may similarly have components that can be independently active. How this composite value is reflected in a single indicator may be challenging.

Diversity of low-power modes

Many devices have multiple low-power modes. Some, such as display dimming or processor clock slowing, may be leave the system more 'awake' than 'asleep' yet still save energy. In many cases it is desirable to not require users to be exposed to the diversity of all available modes, yet still allow the control for those who need or want it. Such two-tier controls are already used in some devices.

[1] For example, device A may have a user interface and controls for it to power manage device B; device A may have a user interface to query and change the controls for device B, but with the control function residing in device B.

Power management 'schemes'

Several operating systems already provide for sets of power management settings to be saved together for ease of setup (logical default schemes can be provided) and switching. It may be desirable to provide guidance for names and implications of some default schemes.

Temporary changes

Sometimes a user may want a temporary change in the power management scheme until some event has passed. Disabling monitor power management for presentations and while diagnosing a system problem are common applications of this. Having an explicit facility for temporary disabling would reduce the degree to which these become permanent.

How should power management interact with External Actions?

Interactions with non-power modes

Power status is often not the only indication present on a device. For example, there may be indicators for error modes (e.g. paper jam), warnings (e.g. low toner, network connection lost), or that a message has been received. These other modes may interact with power management status (e.g. forcing or preventing sleep), and may utilize the same scarce indicators. For example, a single LED could change color with the power state, and flash for error or message indications.

System Status after power failure

An increasing portion of computers offer the ability to control the systems state after a power failure, either always staying off, always rebooting, or whichever state the system was in prior to the power failure.

How should the interface treat Mode Transitions?

Changing power states

Devices may change their power state (to on, low, or off) based on delay timers, weekly timers, a controlling device, user input, or action of a controlling device. Some may also respond to external stimuli such as electricity prices. For user input, simplicity and consistency of changing power states is desirable. This might be a switch/button, a switch analogue (e.g. laptop lid), keyboard input, mouse movement, voice use ("wake up!") or occupancy. Common actions will be turning on (from off), turning off (from sleep or on), putting to sleep (from on), or waking up (from sleep). In some cases, wakeup signals such as key presses need to be ignored as the effect may be unknown without necessary context from a display which is off. Some devices presently have "hot keys"—specific keypress combinations which cause a particular action, so a standard convention for such keys may be helpful.

Transition indicators

Any transition between two power states could potentially cause some type of external indication. Many devices make different noises in different power modes (e.g. when fans, disks, or motors change state), or do so on transitions (e.g. when these mechanical devices spin up or down). Some computers make intentional extra sounds when booting up, or waking up (such as a 'beep') to confirm to the user that the process is underway. Such indicators can help when devices can't be seen (e.g. PCs under a desk), or take time to accomplish (e.g. a slow monitor).

Quick state transitions

Devices may enter short wake states in the midst of a long sleep period, or vice versa. States smaller than some minimum should probably be suppressed with respect to external indicators, as they may be difficult to discern and/or distracting.

Behavior based on wake event type

As devices become more networked, an increasing number of wake events may not be relevant to the user, such as file access by a remote user or automated downloading of information or software. These may only require a portion of the machine to wake up and may have different sleep delay times appropriate . The potential number of combinations of such controls are large, so methods to group and simplify these will be needed to optimize energy savings.

Linked behavior

Some current computers will provide an option to automatically save open files before shutting down the system, and having the ability to applications run on system startup or shutdown is quite common. Some consistent terminology may be appropriate, as may be the ability to do actions based on going to sleep or waking up.

What are the most effective Operating Metaphors?

Underlying archetype of power management behavior

It may be that a common analogue or archetype is desirable to help people learn and remember power management terms and behavior. An example of this is the idea of devices going to 'sleep'. This can bring in symbols (the moon and sun) and other terms ("waking up"). Variants can also be introduced (e.g. "snooze", "doze", "deep sleep", or "hibernate"). Another analogue could be 'active' vs. 'resting'.

Role of the term "ENERGY STAR"

It is common for users and manufacturers to use "power management" and "ENERGY STAR" synonymously, even though some compliant devices lack power management, and some with power management do not qualify as ENERGY STAR. While there is initial utility in such ambiguity, it is probably better for the long run to keep the ideas separate.

What are Potential Byproducts of this project?

Terminology

Useful information for attempts to achieve convergence on power mode terminology not generally intended for final user use, such as in power management protocols, test procedures, and by labeling programs such as ENERGY STAR.

Imaging

Insight on how some user interface convergence might be achievable for imaging controls to improve user experience and facilitate greater use of paper-saving features.

Other Topics

Miscellaneous

Many devices are confronted with confounding factors or anomalous situations that can challenge power management controls and indicators. Some of these are: Multiprocessor systems (which may be in different power states); operating system upgrades (which may 'lose' configuration settings); uncertainty about what wakes the system (particular when this depends on how a device is connected to a PC); software setting of hardware button behavior; and distributed processing (e.g. SETI@home).

Self-monitoring

Some systems and add-on software provide for tracking power management states over an extended period of time. Some conventions on recording and reporting of this may aid comprehension of such data.